

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



PG 665

LIBRARY  
RECEIVED  
1908

B. P. I.—392.

Issued August 6, 1908.

United States Department of Agriculture,  
BUREAU OF PLANT INDUSTRY,  
Field Investigations in Pomology.

FACTORS AFFECTING THE KEEPING QUALITY OF TABLE GRAPES  
WHILE IN TRANSIT AND IN STORAGE.

INTRODUCTION.

During the past seven years the Bureau of Plant Industry of the United States Department of Agriculture has conducted investigations to determine the factors that govern the successful shipment and storage of fruits. There have been included in these investigations apples, pears, peaches, plums, oranges, grapes, and small fruits.

It has been shown that the different kinds of molds which cause the most common forms of decay in these fruits while in transit and in storage are unable to penetrate the sound, normal skin of the fruit. These molds generally gain entrance through mechanical abrasions produced in the preparation of the fruit for market. It is not unusual to find 10 per cent of apples showing cuts or abrasions in the skin. Small fruits are more commonly injured, while oranges frequently show from 10 to 50 per cent of the fruit with the skin cut by the clippers in severing it from the trees or by rough handling of the fruit in the packing houses. It has been demonstrated that by careful handling in the picking and packing of oranges under commercial conditions the injuries can be overcome and the decay can be almost wholly eliminated.

INVESTIGATIONS WITH TABLE GRAPES.

During the past two years the storage investigations have been extended to the table-grape industry of California. The investigations were started with two objects in view: A study of the factors which may affect the keeping quality of the grape in transit and in storage on the one hand and, on the other, the possibility of extending the marketing season of California grapes by cold or common storage with a view to the possible replacing with the California product of the \$1,500,000 annual importation of fresh Spanish grapes.

The preliminary investigations have shown that most of the injuries to grapes in handling occur at the point where the berry joins the stem—the pedicel. Other forms of injury are broken and cracked berries produced by rough handling or excessive squeezing in packing. The pedicel breaks are perhaps the most difficult to control, especially in tender



varieties. The simple bending of a berry to one side may cause a break at the pedicel, frequently so slight as to be nearly invisible but sufficient to allow the entrance of the mold. These broken berries under proper conditions of heat and moisture will show mold in a few days. After the mold has started it will continue to develop and spread in the ordinary grape package even at a temperature near the freezing point.

#### COLD STORAGE EXPERIMENTS.

A few examples will suffice to show how great an influence careful handling and packing may exert on the keeping qualities of table grapes. Sixteen of the leading varieties of table grapes, some of which are grown commercially in California, were used in cold storage experiments. All of the grapes were handled with the greatest possible care and were packed in different ways, after which the fruit was held in cold storage. The varieties studied are the Flame Tokay, Muscat, Thompson Seedless, Ferrara, Emperor, Verdal, Black Prince, Malaga, Cornichon, Huasco, Bowood, Pizzutella (Lady Finger), Perruno, Chas-selas de Fontainebleau, Zabalkanski, and Almeria.

Table 1 shows some of the results obtained in the cold storage experiments in 1906 and 1907. The open crates were firmly packed, but not high enough to necessitate squeezing. The table also shows results with the same varieties packed in tight boxes with fillings of ground cork and redwood sawdust, and, for comparison, the Flame Tokay and Emperor varieties packed for commercial shipment without extra precaution in handling.

TABLE 1.—*Length of time table grapes were held in sound condition in cold storage in 1906 and 1907.*

Variety.	Packed in ordinary open crate.	Packed with cork filling.	Packed with red- wood saw- dust filling.
	<i>Days.</i>	<i>Days.</i>	<i>Days.</i>
Flame Tokay .....	40 to 60	65 to 100	-----
Muscat .....	30 to 40	90 to 100	110
Malaga .....	30 to 35	90 to 115	120
Black Prince .....	20 to 30	70	-----
Black Ferrara .....	40 to 60	90	-----
Purple Cornichon .....	45 to 60	80 to 140	150
Verdal .....	20 to 25	100 to 110	130
Pizzutella .....	20 to 35	70 to 90	110
Almeria .....	80 to 100	95 to 150	170
Flame Tokay, commercial pack .....	<sup>a</sup> 10 to 20	-----	-----
Emperor, commercial pack .....	<sup>b</sup> 30 to 40	-----	-----

<sup>a</sup> Contained 25 to 40 per cent of injured berries. Delay of four days between picking and storing.

<sup>b</sup> Contained 10 to 12 per cent of injured berries.

The commercial packs of Flame Tokay and Emperor were the usual high pack. The grapes were subjected to quite severe squeezing, although both lots were extra cleated. The percentages of injured berries were too high to make long keeping possible.

The length of time given in the table refers to the limit of first-class condition as indicated by freedom from mold, decay, and dropping from the stems.

All varieties shown in the table with the exception of the commercially packed Flame Tokay and Emperor were packed soon after picking and were shipped immediately. Not more than thirty-six hours elapsed between picking and placing the fruit in cold storage.

It has been shown in the investigations with other fruits that one of the most important factors in the successful handling of fruits either in storage or in transit is quick shipment or quick cooling after the fruit is harvested. The sooner the fruit can be cooled after it leaves the tree or vine the longer time it will continue in first-class condition. This is especially true where there are any appreciable mechanical injuries in handling. It has been shown with oranges, for example, that after a delay in shipping or cooling of two to four days, the decay in transit may be from two to five times greater than under immediate shipment or cooling, depending upon the amount of mechanical injury in the fruit. These factors of quick shipment and quick cooling are likely to be as important and perhaps more important with grapes than they are with oranges, for the reason that the ordinary grape package offers ideal moisture conditions for the development of molds and if the proper heat conditions are present molds are almost sure to occur. In the case of the commercial pack of Tokays shown in the table, mold had already made its appearance on the arrival of the fruit at the storage house four days after picking. These crates were shipped by express and consequently had no cooling in transit.

The data presented have an important bearing on the problems dealing with the safe handling and transportation of table grapes. They show that under proper conditions of handling and packing the more tender varieties may be held in sound condition beyond the time required to reach distant markets.

This circular is issued in order to call the special attention of grape growers and shippers to the value of careful handling and quick shipment and cooling in the hope that its suggestions may be of service during the coming shipping season.

A. V. STUBENRAUCH,  
*Expert in Fruit Transportation.*

Approved:

B. T. GALLOWAY,  
*Chief of Bureau.*

*Arnold  
Valentine*

WASHINGTON, D. C., July 27, 1908.



